Energy Affordability in the EU:
The Risks of Metric Driven Policies

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Abstract: This paper provides a pan-EU mapping of energy affordability using energy expenditure shares for the first time. Large variations in energy expenditure shares across the EU are identified, with the shares being significantly higher in New Member States than the EU15. These variations indicate that a pan-EU fuel poverty metric is inappropriate. Secondly, household-level data from the UK, France and the Republic of Ireland are used to simulate the impact of policy interventions on the recorded rate of fuel poverty. These simulations highlight that emphasising high-level fuel poverty metrics may distort policymakers' decisions towards manipulating the 'picture' of fuel poverty rather than maximising welfare improvements; policymakers may assist households lying closest to fuel poverty thresholds rather than those most in need. Robust impact assessments identifying the fuel poverty interventions which deliver the greatest welfare increases for a given cost offer a better means of policy evaluation.

1. Introduction

Energy[3] affordability has become an increasingly important issue in the EU[4] with CEER-BEUC's 2020 Vision for Europe's Energy Customers[5] including 'Affordability' as one of its four core principles to which energy regulators should adhere. The current paper complements the literature on fuel poverty in the EU in two ways. Firstly, rather than mapping fuel poverty using European Union Statistics on Income and Living Conditions (EU-SILC)[6], energy expenditure shares map the more general issue of energy affordability through time.[7]

Secondly, the impact of policy interventions on the percentage of households devoting at least 10% of their expenditure to energy (this percentage is now referred to as ENEX10) is

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[2] This paper draws evidence from a report commissioned by the Centre on Regulation in Europe and the financial support of the project's sponsors (Microsoft, EDF Energy, the Utility Regulator Northern Ireland and E-Control, the Austrian energy regulator) is gratefully acknowledged. The main output, Deller and Waddams (2015a), can be downloaded from http://www.cerre.eu/publications/affordability-utilities%E2%80%99-services-extent-practice-policy. The author thanks participants at a CERRE workshop in May 2015 and a DG Ener presentation in December 2015 for their suggestions and comments, in particular, the generous contributions of Claire Milne. I am grateful to Catherine Waddams for her leadership of the project and comments on drafts of this paper.

[3] The terms "energy" and "fuel" have the same meaning in this paper i.e. all fuel sources used within the home. Following Thomson and Snell (2013), 'fuel poverty' refers to households who struggle to afford energy services.

[4] Thomson et al (2016) document this increasing attention.

[5] See CEER (2014).

[6] This data (or its precursor survey) is used by Healy and Clinch (2002), Thomson and Snell (2013) and Bouzarovski and Tirado Herrero (2015).

[7] The European perspective also extends Advani et al (2013) beyond the UK.

investigated. This complements the work of Heindl and Schuessler (2015), by extending fuel poverty simulations to the UK, France and the Republic of Ireland (RoI) and highlighting how the ability to improve *recorded* fuel poverty is determined by the energy expenditure share distribution.

The core argument of the present paper is that considerable thought is required before high-level metrics become 'hard-wired' into policy making and policy evaluation processes. While gathering evidence on the extent of fuel poverty is essential, this evidence should be seen 'in the round' and levels of individual indicators should not be used as 'targets' against which policy performance is assessed.

In Section 2 the energy expenditure share data emphasises a striking difference between the EU15 and New Member States (NMS). In 2010, the average energy expenditure share across the EU15 was 4.6%, but among NMS it was 10.9%. Given these figures, adopting a common fuel poverty metric across the EU[8] would be problematic; in some NMS such a high proportion of the population would be identified as fuel poor that the classification's usefulness would be lost. The large variations also suggest that a 'rational' EU-wide fuel poverty policy would require significant cross-border transfers, something which is politically infeasible.

The current paper is a contrast to Thomson et al's (2016) arguments that a common EU fuel poverty definition would be beneficial by increasing fuel poverty's prominence[9] and clarifying the term's meaning. As any fuel poverty definition incorporates value judgements, and social policy is the responsibility of Member States (MS), it is appropriate for democratically elected national governments to choose their preferred fuel poverty definition and policy. Nevertheless, the current paper agrees with Thomson et al (2016) that the EU has a legitimate role in enabling policy synergies across MS. The EU can support synergies by increasing the availability of high-quality pan-EU affordability data and collating robust impact assessments that identify effective policy interventions.

Section 2 also highlights how tracking EU-SILC indicators through time draws attention to challenges in their interpretation. This discussion aims to encourage further research that considers the information provided by EU-SILC indicators in a critical fashion. Alternative indicators are suggested which capture tightly defined situations experienced by fuel poor households.

The policy simulations in Section 3 lead to a more general questioning of using high-level fuel poverty metrics to guide policymaking: their movements may record changes in the *picture* of fuel poverty rather than welfare changes for actual households. The simulations demonstrate that:

(i) even 'large' interventions reduce ENEX10 by relatively small amounts;
(ii) the 'effectiveness' of interventions in reducing ENEX10 depends on the energy expenditure share distribution in the target group;

[8] The live nature of this debate is illustrated by Trinomics' (2016) report for DG Ener.

[9] Bouzarovski et al (2012) argue that the lack of an institutional centre has made fuel poverty's position within European institutions precarious.

(iii) and increasing household income has virtually no impact on ENEX10 despite welfare gains for households.

The policy implications of these findings are explored in Section 4. The risks of an 'official' high-level metric are reinforced by official statistics receiving considerable, and possibly simplistic, attention in political and media debates. Hard pressed policymakers may adopt policies producing the largest improvements in the official metric rather than those delivering the greatest welfare improvements. Policymakers need to accept that most fuel poverty metrics are likely to be imperfect: metrics with desirable statistical characteristics may be difficult to communicate to non-specialists or require extensive, i.e. costly, data collection. Robust impact assessments are a more direct way to assess the benefits of fuel poverty interventions.

2. Mapping Energy Affordability Across the EU

The Eurostat Expenditure Share Data

A pan-EU perspective on energy affordability can be obtained using two data sources: (i) Eurostat's collated household budget survey database[10] and (ii) EU-SILC data. (i) enables comparison of average energy expenditure shares, while (ii) provides indicators including the percentage reporting an 'inability to keep your home adequately warm' and the percentage reporting 'arrears on utility bills'. The existing literature focuses on the EU-SILC data as it provides annual indicators which fit intuitive concepts of fuel poverty.

The Eurostat expenditure share data has less to say on fuel poverty directly as the focus is household averages. Additionally, the expenditure data is only available at 5 year intervals, ending in 2010. Yet expenditure shares have clear value for understanding energy affordability and, in particular, the political economy surrounding energy markets. The increasing emphasis on fuel poverty might represent a political response to a decline in affordability for average households, as much as increased concern for the fuel poor.

Before reporting the expenditure share results, understanding some methodological points is important. Firstly, the observed variations between MSs may reflect variations in definitions, survey timing and methodologies. In particular, the UK, Czech Republic and Hungary do not include imputed rent for owner-occupiers in total expenditure. This increases the (apparent) energy expenditure shares of these MS compared to other MS. Secondly, only central values are reported by Eurostat, we cannot confirm whether differences between expenditure shares are statistically significant.

Lastly, the average expenditure shares for the EU15, EU28 and NMS are weighted means: each MS's contribution is weighted by the MS's percentage of the total population of the relevant MS in 2013.[11] The weighted averages use the subset of MS where Eurostat provides

[10] See: http://ec.europa.eu/eurostat/web/household-budget-surveys/database.

[11] Eurostat's averages have not been used as they do not always cover the entire time period or the sub-group of MS considered. The population figures are available at: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_pjan&lang=en

data for all years.[12] This avoids intertemporal fluctuations resulting from changes to the set of MS considered.

Differences in Average Expenditure Shares

The main finding, shown in Figure 1, is that, on average, households in NMS devote a substantially higher proportion of their expenditure to energy than in the EU15 (10.9% vs 4.6% in 2010). The higher expenditure shares in NMS probably reflect significantly lower average incomes in NMS. It is also noticeable that the EU15's average energy expenditure share is stable through time at around 4%.

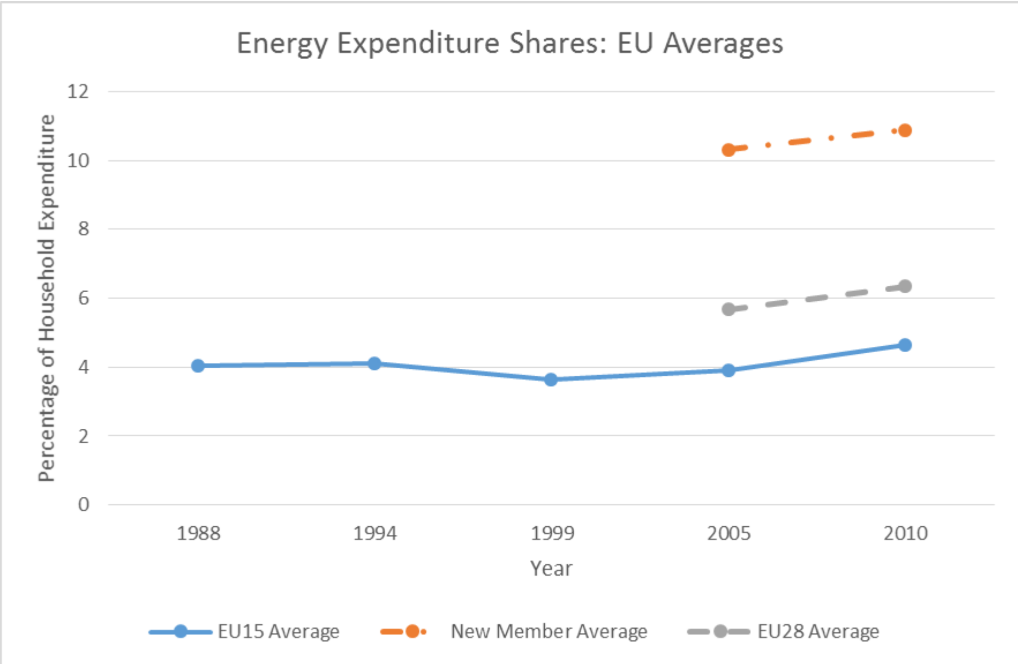

Figure 1: Average energy expenditure shares in the EU15, NMS and EU28

Figures 2 and 3 show that differences between individual MSs can be starker, for example, the average energy expenditure share in Malta in 2010 was 2.7% compared to 16.5% in Hungary. There are also notable variations in the evolution of expenditure shares through time. Figure 3 shows that while Hungarian and Romanian households both spent around 11.5% of their expenditure on energy in 2005, by 2010 the average in Hungary had increased by 4.9 percentage points but had fallen by 2.2 percentage points in Romania.

[12] The EU15 averages may based on only 7 or 8 MS and the MS may vary between figures.

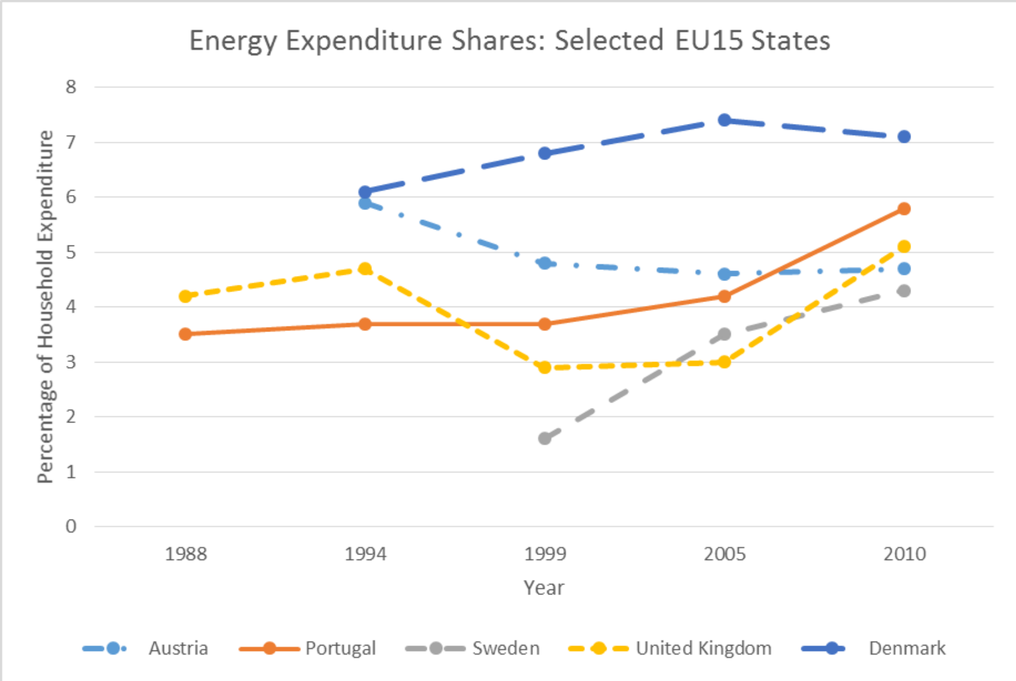

Figure 2: Average energy expenditure shares in selected EU15 Member States

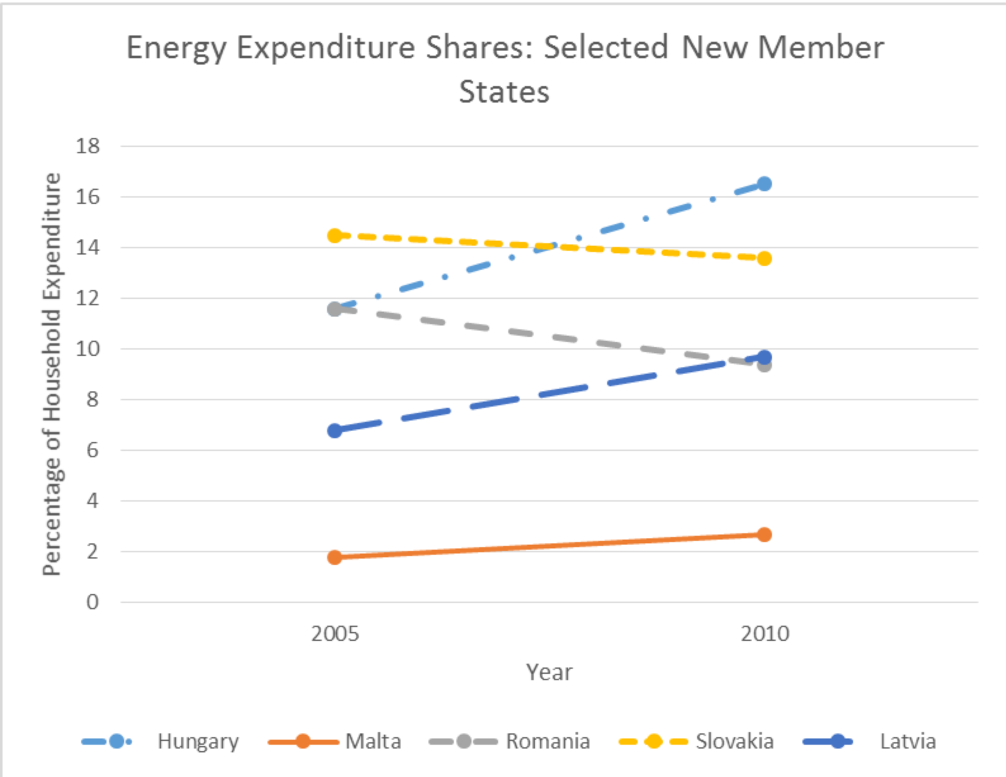

Figure 3: Average energy expenditure shares in selected New Member States

The large differences between MS indicate that a common EU fuel poverty definition is undesirable: a metric/threshold identifying severe fuel poverty in one MS (e.g. Malta) would cover a large section of the population in other MS (e.g. Hungary). That Hungary's average energy expenditure share was 16.5% in 2010 implies the majority of Hungarian households would have been classified as fuel poor according to ENEX10.[13] In Hungary the value of an ENEX10-based 'fuel poor' designation to target resources would be seriously weakened. Also, if a common metric supported an EU-wide fuel poverty policy, a 'rational' strategy would involve resource transfers from MSs with the lowest fuel poverty rates to those with the highest. Realising such a strategy would be challenging as national governments, quite reasonably, are likely to make different judgements regarding acceptable energy market inequalities.

Perhaps recognising that identifying a large percentage of households as fuel poor is unhelpful, EC (2010) suggests an appropriate metric to identify a 'considerable (energy) expenditure share' is twice the national average expenditure share. While such a metric allows a common *and relevant* fuel poverty definition across MS, the households identified as fuel poor in each MS will face very different circumstances. Taking examples from Figures 2 and 3, a fuel poor household in Sweden would have an energy expenditure share of at least 9% in 2010, while a fuel poor household in Hungary would have an energy expenditure share of at least 32%. Metrics linked to the 'average' situation in individual MS enable a comparison of expenditure share inequality between MS[14], but cannot provide straightforward comparisons regarding the *level* of fuel poverty. For fixed expenditure share thresholds, such as ENEX10, the issues are reversed: comparisons of fuel poverty levels between MS are straightforward but a common metric cannot target policies in all MS.

Inequalities in Energy Expenditure Shares

While not addressing fuel poverty directly, the expenditure share data does allow evaluation of more general distributional issues by breaking out expenditure shares by household type. Figures 4 and 5 show the ordering of energy expenditure shares across household types is the same for the EU15 and NMS: retired households and households in the bottom income quintile have the highest expenditure shares, while households with children have the lowest.

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[13] The Czech Republic, Poland and Slovakia also had average energy expenditure shares exceeding 10% in 2010.

[14] A greater proportion of households reporting energy expenditure above 'twice the national average' indicates greater inequality.

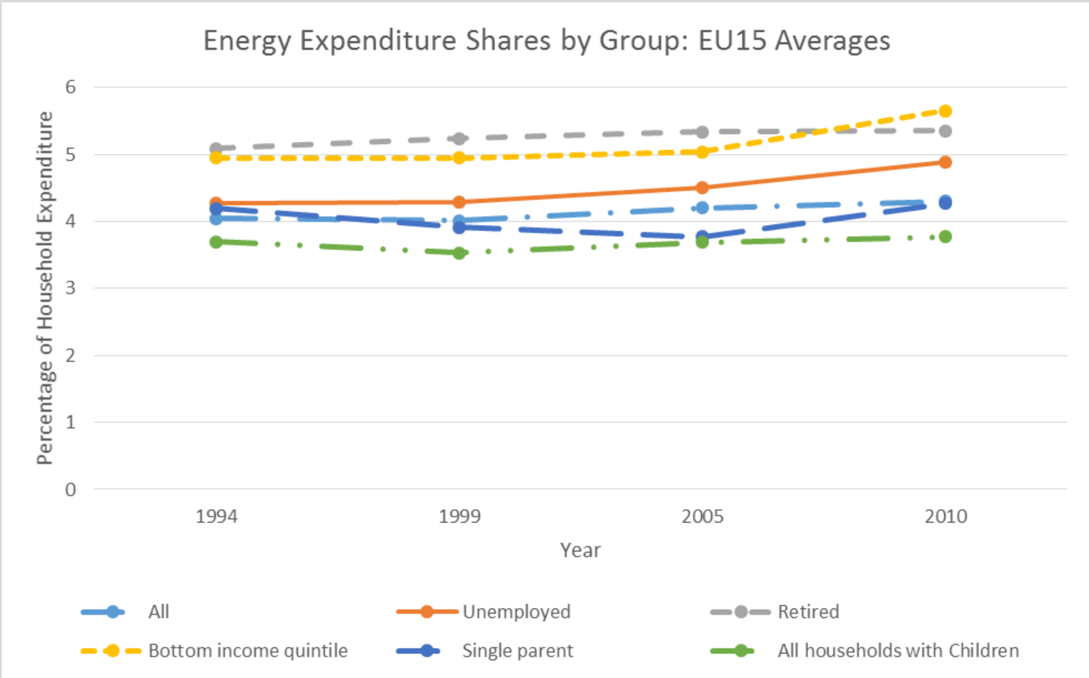

Figure 4: Energy expenditure shares by household type averaged across the EU15

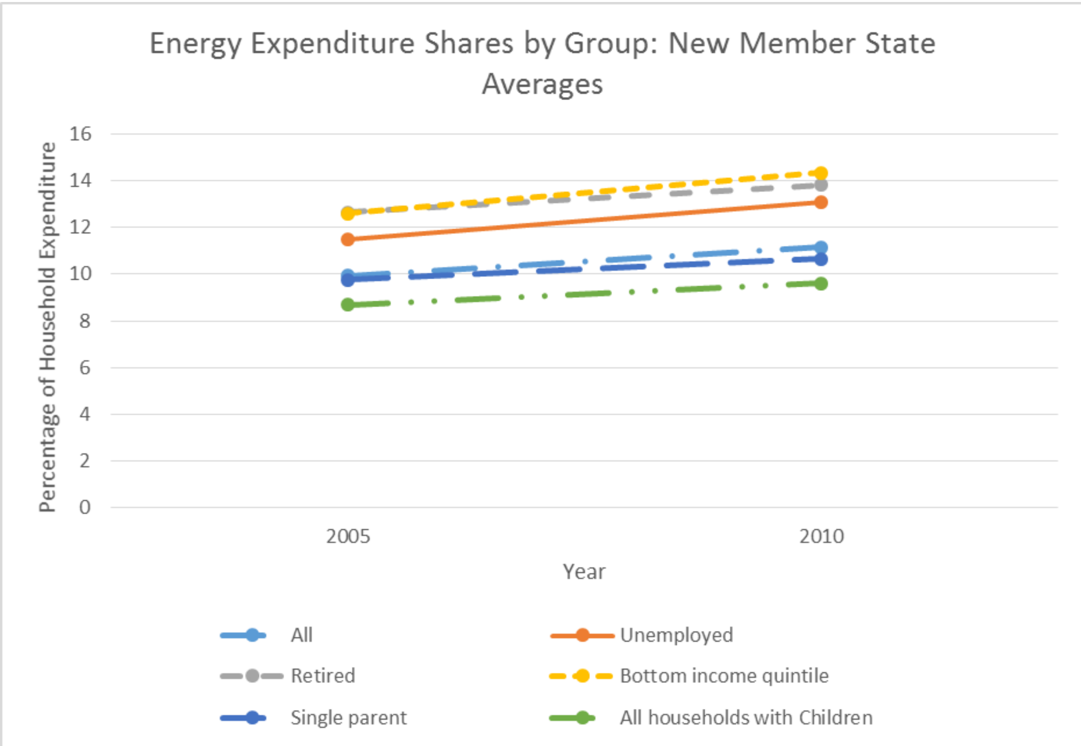

Figure 5: Energy expenditure shares by household type averaged across NMS

The 'equality' of energy market outcomes can be assessed by considering the ratio of the average energy expenditure share for households in the bottom income quintile relative to the average energy expenditure share for all households. This ratio is reported for selected MS in Figures 6 and 7. A higher value indicates greater inequality, however, it does not automatically imply a 'problem' with the energy market: a higher value could result from greater income inequality.

The average energy expenditure share for households in the bottom income quintile is generally 20-50% higher than the average expenditure share for all households. However, within the EU15, Finland, Sweden and Austria have expenditure shares that appear more 'equitable': in 1994 the poorest households in Finland and Austria devoted a *lower* expenditure share to energy than the average household.

In NMS the gap between the low income and all household average generally widened between 2005 and 2010, falling in only three NMS: Hungary, Malta and Poland. This widening might reflect increased liberalisation or the removal of energy subsidies which could lead to prices rising faster than incomes for the poorest households. Figure 7 shows this widening was particularly severe in Latvia. In 2005 the average energy expenditure share of low income households in Latvia was 10% below the all household average, however, by 2010 low income households had an expenditure share that was 53% above the all household average.

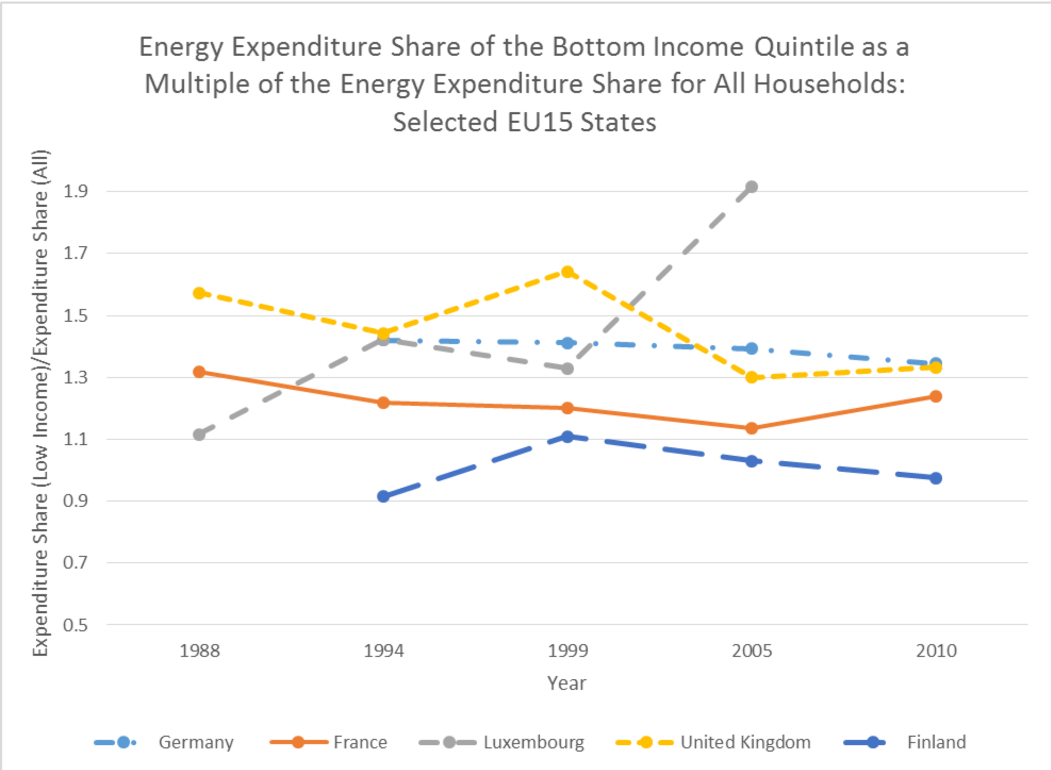

Figure 6: The average energy expenditure share for low income households as a multiple of the average energy expenditure share for all households – selected EU15 Member States

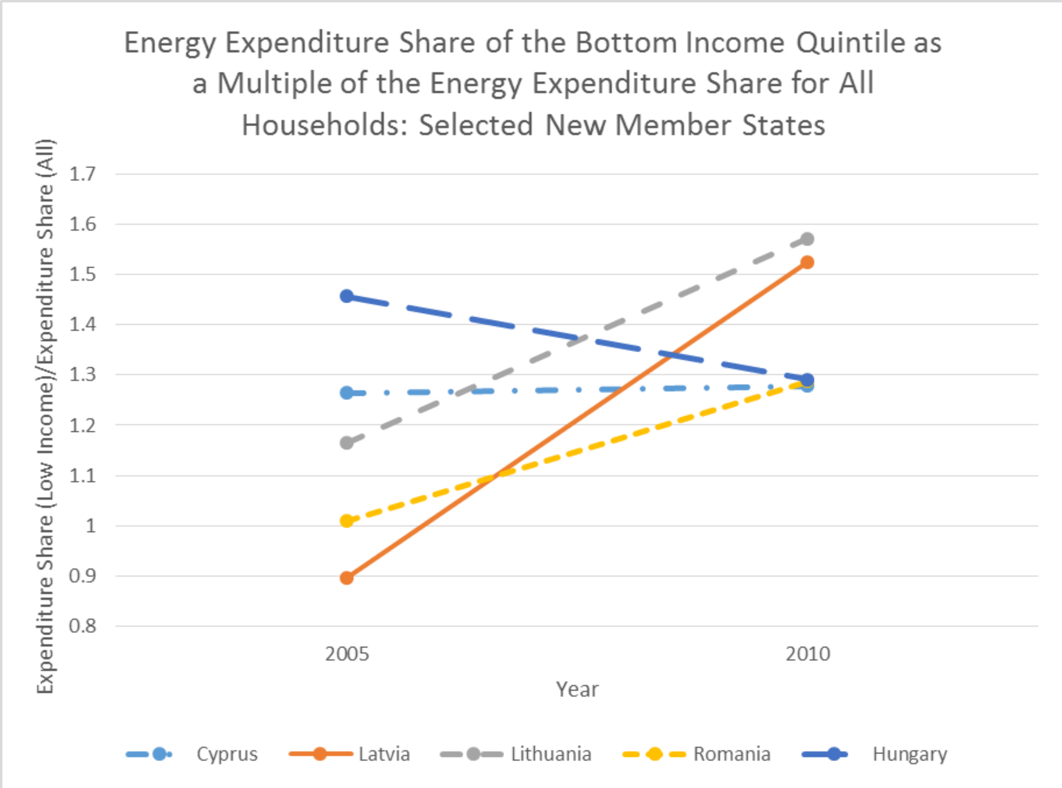

Figure 7: The average energy expenditure share for low income households as a multiple of the average energy expenditure share for all households – selected New Member States

Interpreting EU-SILC Data Requires Caution

While EU-SILC indicators' annual collection is a central advantage over the expenditure share data, the information contained in the EU-SILC data must be critically assessed before these indicators are hard-wired into policymaking. Once these indicators are considered intertemporally the potential for them to be influenced by factors other than households' living conditions becomes apparent. This is not to say that energy expenditure share data is better than EU-SILC data (it is different[15]), but that further research is needed around the messages to take away from EU-SILC data. That a discrepancy exists between households identified as fuel poor according to 'objective' and 'subjective' indicators has been recognised by Waddams Price et al (2012) and Scott et al (2008). This sub-section highlights two examples that warrant further investigation. Two EU-SILC indicators are considered: (a) the percentage of households reporting an inability to keep their home adequately warm, and (b) the percentage of households reporting utility bill arrears.[16]

The key papers investigating fuel poverty across the EU using EU-SILC indicators are Healy and Clinch (2002)[17] and Thomson and Snell (2013), however, their consideration of intertemporal variations is limited. Both sets of authors perform regressions to identify factors associated

[15] For example, data on actual energy expenditure shares cannot identify households who restrict their energy expenditures due to budget pressures.

[16] The percentage of households with leaks, damp or rot has been used in the past as an additional proxy for fuel poverty. This indicator has not been used here as the strength of its link to energy affordability pressures is not entirely clear: damp and rot can result from ventilation issues rather than a lack of heat.

[17] Healy and Clinch use data from EU-SILC's predecessor, the European Community Household Panel.

with households reporting indicators (a) and (b). Thomson and Snell (2013) focus on the cross-sectional variation in fuel poverty between MS using data from 2007, while Healy and Clinch's (2002) consideration of intertemporal changes is limited to 1994-97. Each set of authors also aggregate individual indicators into indices, however, aggregation does not automatically address concerns about the information which the individual indicators convey. Indeed, aggregation can lead to the information from individual indicators being lost.

The first example of issues with the EU-SILC indicators results from comparing the average values of (a) and (b) for the EU15 and NMS. Figure 8 shows a conflicting intertemporal variation for (a) and (b) within NMS. Between 2007 and 2013 the average percentage reporting an inability to keep their home warm in NMS fell by 9.2 percentage points, while the average percentage reporting utility arrears rose by 5.2 percentage points. Looking at these indicators individually would lead to opposite conclusions as to whether energy affordability difficulties were: (i) worsening or improving in NMS and (ii) converging or diverging between the EU15 and NMS.

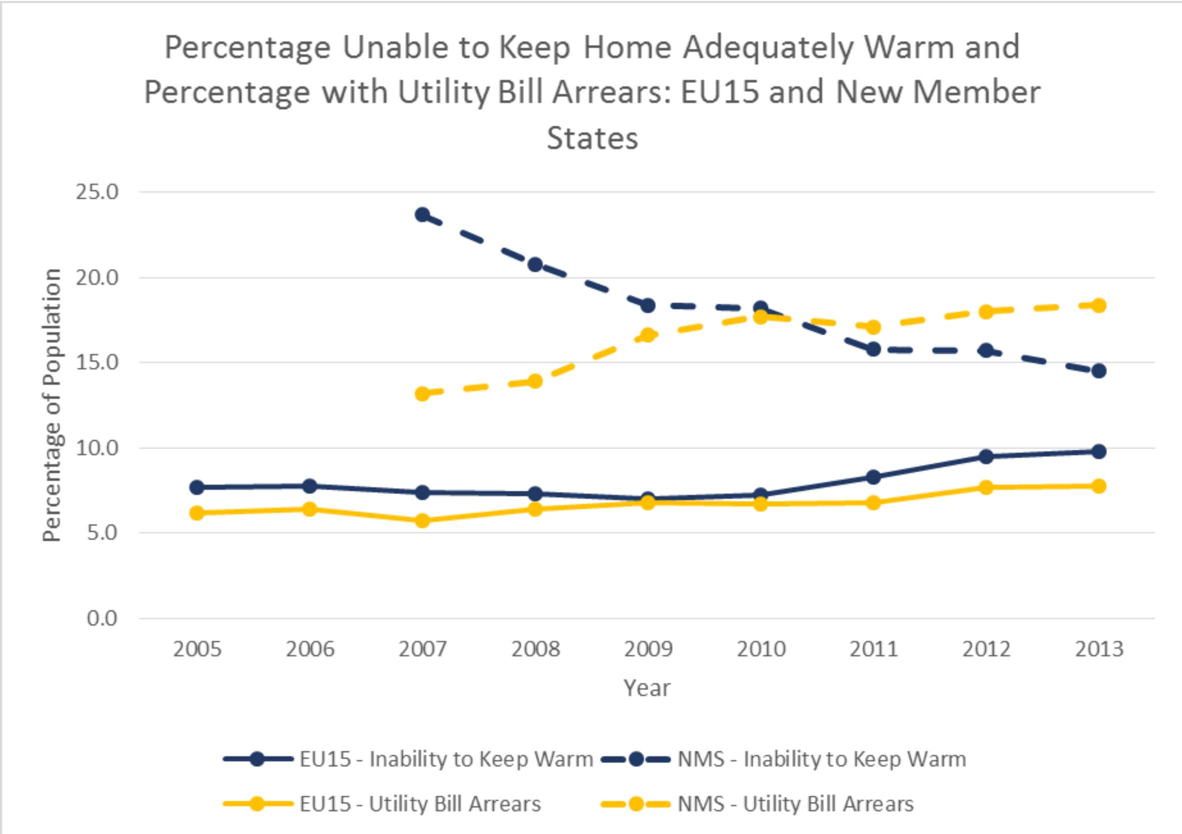

Figure 8: Percentage of the population reporting an inability to keep their home warm compared to the percentage reporting utility bill arrrears in the EU15 and NMS[18]

The second example is to consider indicator (b) broken down by household type. In the EU15 and NMS a similar ordering of household groups by arrears rates exists: in both sets of MS those living in households with one person over the age of 65 are least likely to report arrears. Figure 9 reports the varying arrears rates in the EU15. However, there are at least four

[18] Data for Croatia is excluded as it is only available after 2010.

possible explanations for this observation: (i) older households are wealthier; (ii) policies subsidise utility consumption by the elderly more than other groups; (iii) older households are more conscientious bill payers; and (iv) older households feel a greater social stigma when admitting arrears. While (i) and (ii) involve the fundamentals of fuel poverty, one might be concerned that (iii) and (iv) represent other issues. Understanding the factors driving utility arrears becomes more important when one recalls from Figures 4 and 5 that older households have some of the highest energy expenditure shares.

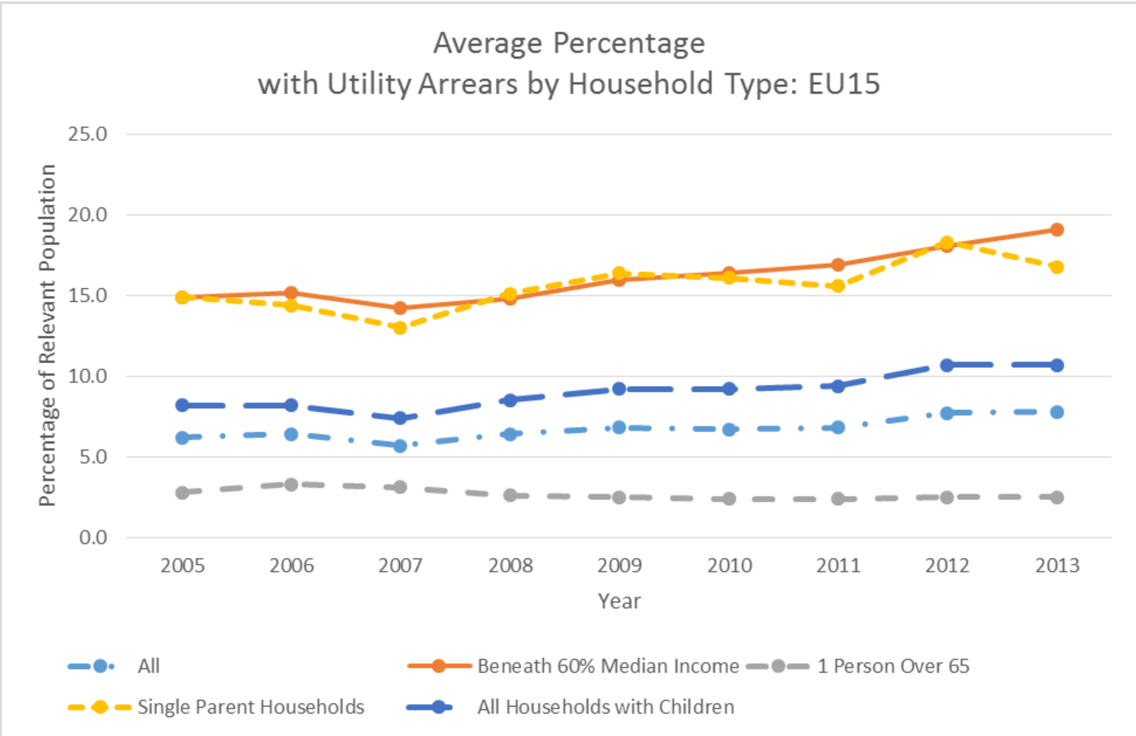

Figure 9: Average percentage of relevant population reporting utility arrears in the EU15 by household type

As indicator (a) involves individuals' perceptions of energy affordability one might be concerned that it could be influenced by political and media debates rather than actual changes in income, expenditure or housing conditions. Similarly, citizens in different MSs might attribute different meanings to terms such as "adequately warm" and "afford". While understanding households' subjective experience is valuable, collecting data on 'objective' indicators seems important. It is worth considering whether alternatives to (a) and (b) exist which are equally cost effective from a data collection perspective[19], but convey more fuel poverty specific information. While (b) is more 'objective' than (a) as it records a specific situation that could be verified, it is a 'noisy' indicator as it includes arrears on bills other than energy. The advantage of an indicator which can be verified is that, with sufficient resources, research could investigate biases from self-reporting.

[19] The greater frequency of the EU-SILC data relative to the expenditure share data probably reflects lower data collection costs. To calculate expenditure shares considerable effort is required to collect data on households' total expenditure, while questions generating EU-SILC style indicators can be introduced into surveys on a standalone basis.

Below are five questions that possess at least one of the following advantages over indicators (a) or (b): (i) an energy specific focus, (ii) a clearly defined situation indicating affordability pressures or (iii) a situation that could be verified:

1. In the last twelve months, has your household been unable to pay your heating, electricity or gas bill on time due to financial difficulties?
2. In the last twelve months, has your electricity or gas supply been disconnected for the non-payment of bills?
3. In the past month, have you consciously restricted the use of energy in your home to ensure you had sufficient money to purchase food?
4. Consider the last time you spent money on energy, did you have to borrow money to make this payment/purchase?
5. During the most recent winter were you forced to keep your home colder than you would like due to financial pressures?

While introducing new forms of measurement raises issues of comparability, the questions above highlight that as fuel poverty research continues to develop there may be advantageous alternatives to the current EU-SILC indicators. The funding of improved/additional data collection focusing specifically on energy affordability is an area where the EU could achieve real impact.[20]

3. Policy Simulations

Although Eurostat's aggregate expenditure share data provides an overview of energy affordability in the EU, a greater understanding requires micro-data from individual households. In the absence of harmonised European expenditure data, policy simulations are performed on micro-data from France, the RoI and the UK.[21] Household level data makes it possible to: (a) compare the fuel poverty rate when using alternative fuel poverty metrics and (b) assess the impact of policies on the fuel poverty rate. The main insight is that, if a policymaker wants to improve the *picture* of fuel poverty, understanding the energy expenditure share distributions among different household groups is key.

The simulations complement work by Heindl and Schussler (2015). Compared to Heindl and Schussler, not only are additional MS considered, but the current simulations are more applied, investigating how targeting policies at alternative household groups influences ENEX10.[22] In contrast, Heindl and Schussler use expenditure and income changes to explore the behaviour of alternative fuel poverty metrics. By considering ENEX10 in MS beyond Germany and a wider range of target groups, the simulations also complement Heindl (2013).

[20] Trinomics (2016) explicitly considers the potential to increase collection of fuel poverty data at the EU level, including additions to EU-SILC data.

[21] The UK and RoI were chosen due to the free availability of their household budget surveys and English documentation. France was selected due to the interests of a CERRE sponsor. Additional detail on the simulations is available in Deller and Waddams (2015b), Deller and Waddams (2015c) and Deller and Waddams (2015d).

[22] ENEX10 was chosen due to its intuitive behaviour when income and expenditure change.

The Data

The datasets used in the simulations are: the Living Costs and Food Survey 2012 for the UK, the Enquête Budget de Famille 2010-11 for France and the Irish Household Budget Survey 2009-10 for the RoI. As the surveys occur in different years and have differing methodologies, each MS is treated as a 'case study'. For brevity, the simulation results for France and RoI are reported in the Appendix along with additional detail on the data. The main qualitative conclusions, which are similar across the MS, can be understood using the UK simulations.

The simulations consider actual energy expenditure shares rather than required expenditure and energy expenditure is defined as all fuels used to provide heat and power to a household's primary and (where relevant) second dwelling.[23] Total expenditure includes all housing costs recorded in each dataset. All reported statistics are central estimates.

Simulation Methodology

The policy simulations investigate the impact of four interventions:

(a) 250 euro increase in income (proxied by increasing total expenditure)

(b) 50 euro decrease in energy expenditure

(c) 100 euro decrease in energy expenditure

(d) 250 euro decrease in energy expenditure[24]

These figures were chosen as plausible amounts in the context of the size of energy bills. They represent additional interventions over and above any fuel poverty schemes in place when the surveys took place. The particular policies that achieve (a)-(d) (e.g. improved insulation vs monetary transfers) are not assessed, rather the effect of (a)-(d) on ENEX10 is evaluated. It is assumed that the expenditure reductions do not reduce households' welfare, simply the cost of energy services. Interventions (a)-(d) are targeted at different sections of the population, e.g. single parent households vs retired households, with the target groups chosen according to the availability of identifiers within each survey.

The first step in the analysis was to estimate ENEX10 for the population as a whole. Interventions (a)-(d) were then applied to the different target groups.[25] Since energy expenditure is a component of total expenditure, total expenditure was also recalculated after interventions (b)-(d).[26] Lastly, ENEX10 for the population as a whole was recalculated after each intervention.

[23] The simulations do not apply the corrections for seasonality and infrequent energy purchases performed in Advani et al (2013).

[24] For the UK, conversion into pounds sterling used the market exchange rate on 29 June 2012 of 0.8068 euros to the pound.

[25] If an intervention resulted in negative energy expenditure, expenditure was put to zero in France and the RoI. This was not done for the UK as the raw data treated negative expenditure as legitimate due to rebates associated with the UK's energy billing system.

[26] If this adjustment did not occur, interventions (b)-(d) would have a slightly greater impact on reducing ENEX10.

An 'effectiveness' metric was constructed which normalises the percentage point change in ENEX10 by the size of the monetary intervention and the size of the household group targeted. For example, the percentage point change in ENEX10 when a policy was targeted at households containing someone aged 65 or over was divided by the percentage of households in this group. To equivalise for the size of the monetary interventions (€50 is the baseline) percentage point changes for a €100 decrease in energy expenditure were divided by 2 and percentage point changes for a €250 decrease in energy expenditure or a €250 increase in total expenditure were divided by 5. It is tempting to interpret 'effectiveness' as the extent to which ENEX10 can be reduced for a given cost, however, this is only correct when the interventions involve monetary transfers. Effectiveness is placed in inverted commas as the metric illustrates how interventions alter the *picture* of ENEX10 fuel poverty rather than households' actual welfare.

Two benchmarks are included in the results to aid interpretation: (i) applying each monetary intervention to all households (indicating their maximum impact) and (ii) applying each intervention to households with energy expenditure shares in the top decile.

Policy Simulations - Results

Figure 10 shows how the interventions alter ENEX10 in the UK. The magnitude of the drops in ENEX10 are primarily driven by the size of the target groups. Since the target groups are relatively large (comprising up to a third of households), that most interventions have a small impact on ENEX10 is telling. That high level metrics are difficult to influence is one reason to question their use to assess policy effectiveness.

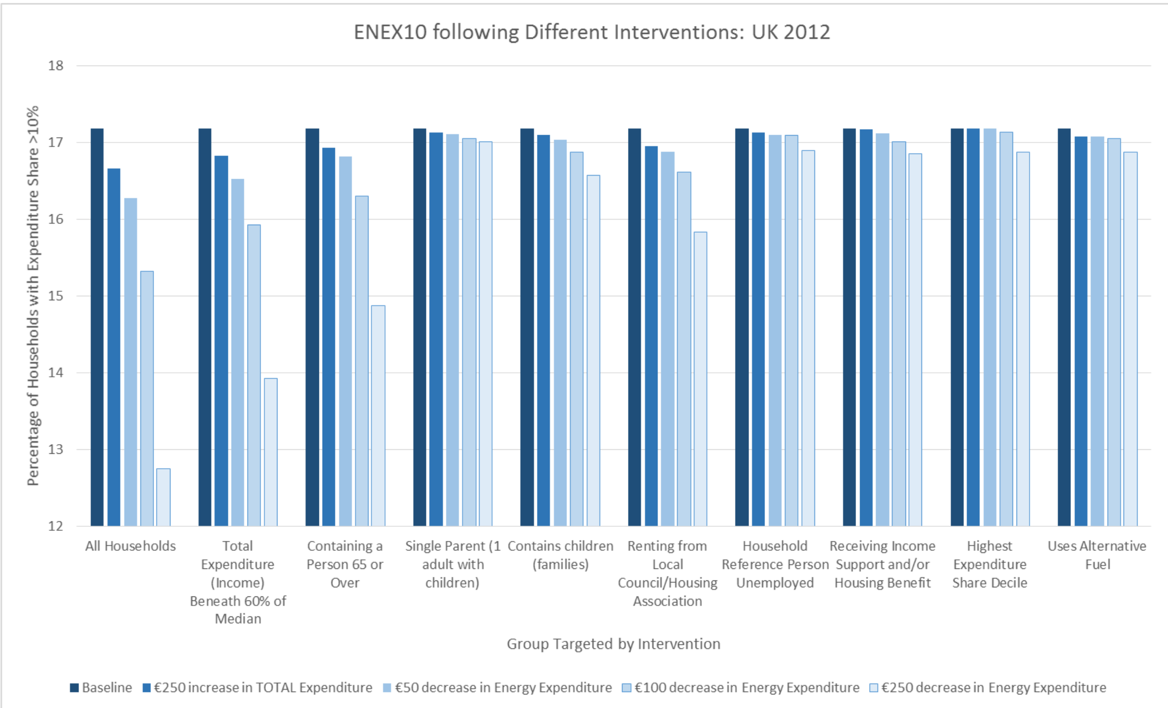

Figure 10: Interventions' impact on the percentage of UK households with an energy expenditure share exceeding 10% in 2012

Figure 10 shows that if every household in the UK in 2012 had their energy expenditure reduced by €250, ENEX10 would fall by 4.4 percentage points. Targeting a €250 energy expenditure reduction at households with total expenditure beneath 60% of the median or at households containing at least one person aged 65 or over also produce relatively large falls in ENEX10 (decreases of 3.3 and 2.3 percentage points).

Reducing energy expenditure has a far greater impact on ENEX10 than increasing total expenditure (income). Increasing all households' total expenditure by €250 reduces ENEX10 by less than 0.5 percentage points. The apparent poor performance of income transfers results from the denominator (total expenditure) being much larger than the numerator (energy expenditure) in the ratio describing the energy expenditure share. However, this is not a recommendation for energy expenditure reductions over income transfers. Standard microeconomic theory indicates that increasing a household's income should raise their welfare by the same, or greater amount, than increasing consumption of a particular good/service. While a fuel poor household will value free additional energy, they may value additional food even more.

Targeting interventions at households with the highest energy expenditure shares has a very limited impact on ENEX10. Reducing the energy expenditure of this group by €250 reduces ENEX10 by only 0.3 percentage points. This highlights that the 10% of UK households with the highest energy expenditure shares have expenditure shares which generally far exceed the ENEX10 threshold.

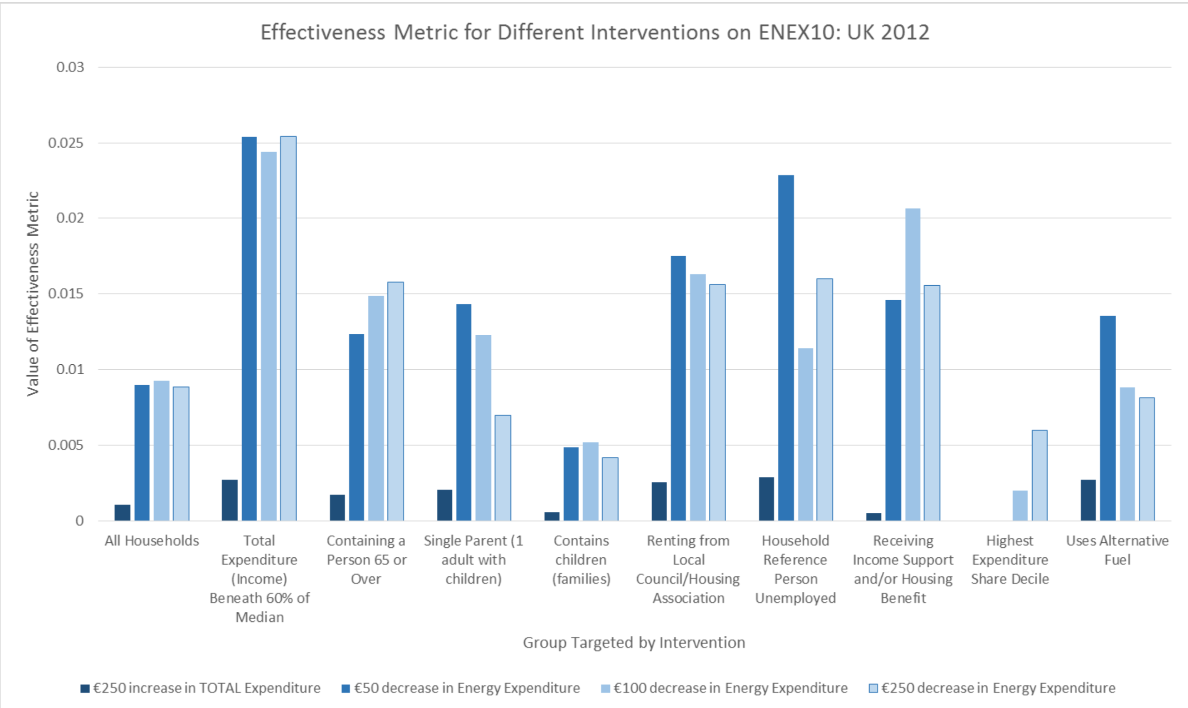

Figure 11: Effectiveness of interventions on reducing the percentage of UK households with an energy expenditure share exceeding 10% in 2012

The 'effectiveness' metric shows greater variability across interventions. The relative effectiveness of interventions is best understood by comparing an intervention's effectiveness value against that when the monetary amount is given to all households, i.e. there is no targeting. Figure 11 shows the most effective interventions in the UK are expenditure reductions targeted at low income households. That expenditure reductions targeted at low income households have similar effectiveness indicates that the density of the energy expenditure share distribution is fairly constant above the ENEX10 threshold for low income households. The other reasonably effective interventions are expenditure reductions targeted at households in social housing, where the household head is unemployed or receiving income support or housing benefit.

Also, Figure 11 shows that for single parent households and households using alternative fuels as the expenditure reduction expands from €50 to €250 effectiveness declines. This indicates a relatively large proportion of fuel poor households in these target groups have energy expenditure shares just in excess of 10%. In contrast, for households containing someone aged 65 or over, effectiveness increases as the expenditure reduction grows from €50 to €250, suggesting that a greater proportion of older fuel poor households have expenditure shares lying significantly above the ENEX10 threshold.

4. Policy Implications

The Importance of Expenditure Share Distributions

The simulations highlight that whether an intervention is 'effective' depends on the energy expenditure share distribution of fuel poor households in the target group. If a policymaker judges success by large movements in high-level metrics, rather than maximising the welfare gains of fuel poor households, understanding this distribution is particularly important. The distorting influence of such an approach can be understood using Figure 12.

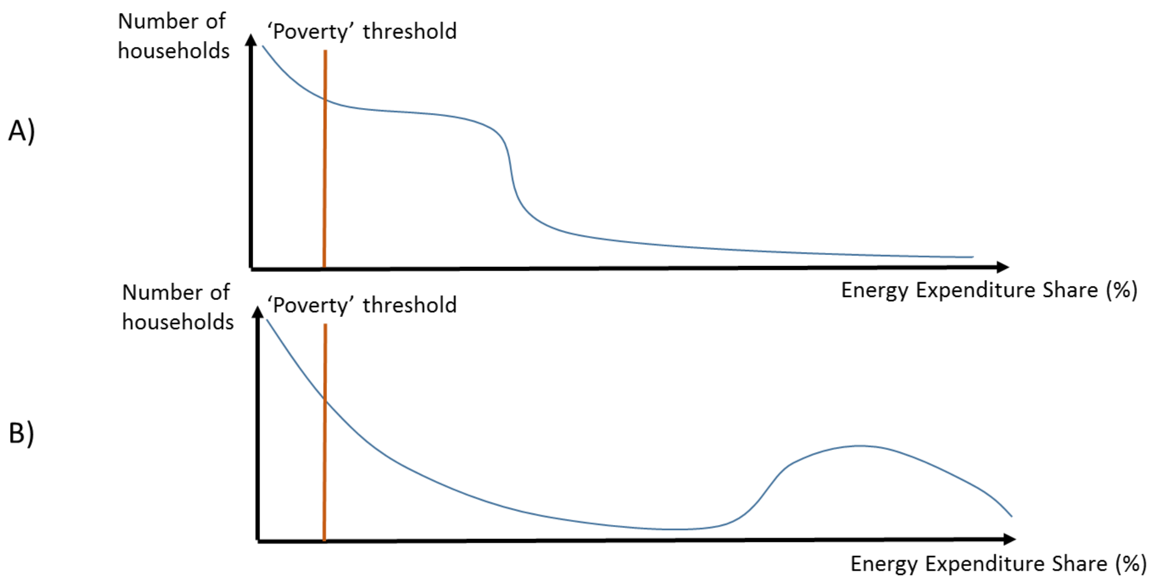

Figure 12: Alternative energy expenditure share distributions

In A) the majority of the fuel poor lie just above the poverty threshold, while in B) there is a large mass of households some distance above the threshold. In A), a policymaker might choose interventions that reduce energy expenditures by only a small amount. This will noticeably reduce the fuel poverty rate at a relatively low cost, but will have limited impact on households in the deepest fuel poverty. Secondly, if A) and B) are alternative target groups, a policymaker focusing on high-level metrics would target A) as the fuel poverty rate could be reduced at a lower cost. [27][28] More generally, and more positively, understanding energy expenditure share distributions for different groups could help to target resources at those most in need.

A Policymaking Framework

A wide range of fuel poverty/affordability metrics have been suggested beginning with Isherwood and Hancock's (1979) and expanding greatly in the years following Boardman (1991). Figure 13 shows how the choice of metric can significantly alter the *recorded* fuel poverty rate. In particular, the LIHC metric dramatically reduces the recorded fuel poverty rate. In the UK, the LIHC indicator[29] more than halves the fuel poverty rate compared to ENEX10, from 17.2% to 8.4%. Yet, the main point of Figure 13 is that while the choice of metric alters the *recorded* fuel poverty rate, the economic positions and lived experiences of households remain unchanged. This highlights why an excessive emphasis on high-level fuel poverty metrics should be avoided. The choice of high-level metric only affects households' actual experience if the policymaking processes is imperfect, so changing the metric alters the resources available for fuel poverty alleviation, or a policy's targeting mechanism is explicitly linked to a high-level metric.

[27] This assumes A) and B) contain the same number of households and each group responds in a similar way.
[28] These incentives are also identified by Heindl (2013).
[29] Compared to the UK's official LIHC indicator, in the current analysis total expenditure proxies household income and actual rather than required energy expenditure is used.

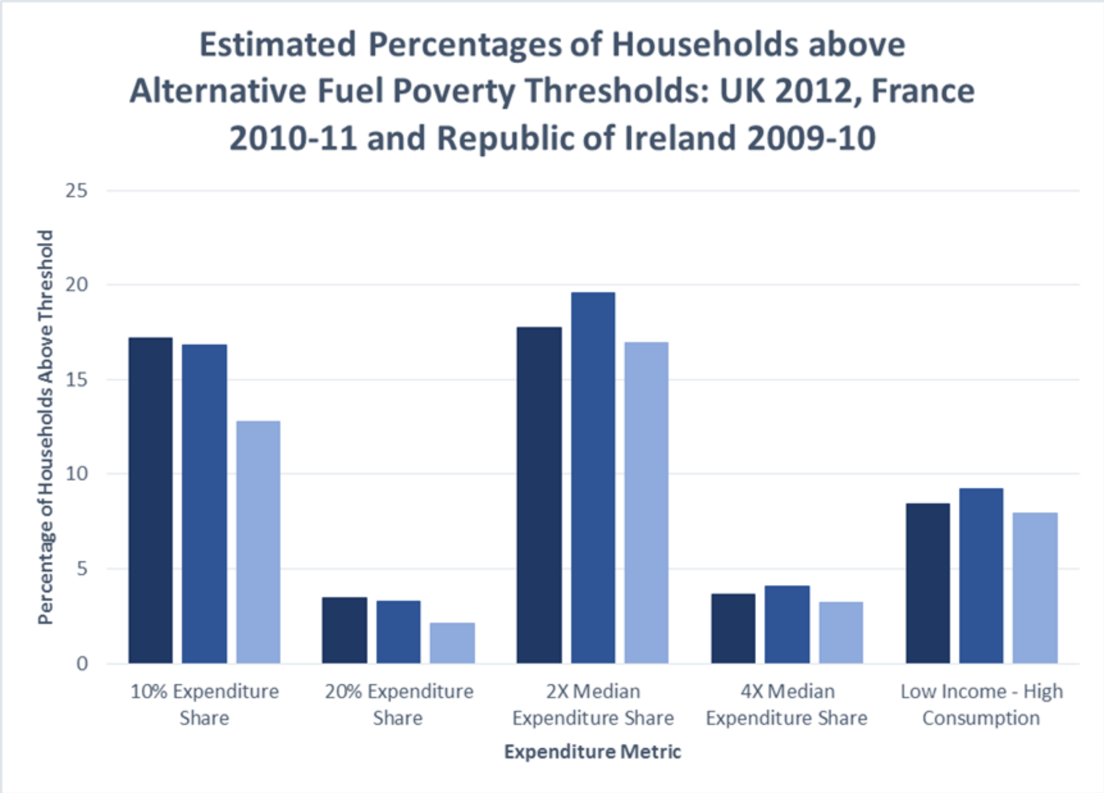

Figure 20: Percentage of households above alternative fuel poverty thresholds in the UK, France and RoI

All of the metrics listed above incorporate various value judgements and assumptions. While monitoring the extent of fuel poverty is essential, policymakers hoping to identify an 'optimal' fuel poverty metric should recognise that finding a metric which is intuitive to understand, has desirable statistical properties and can be widely applied at a reasonable cost is very hard. A second message is that different metrics, and the concepts that lie behind them, may suit different tasks. For example, ENEX10 based on actual energy expenditures is useful for assessing changes in the political salience of energy affordability, but far from ideal for targeting interventions. In contrast, while the LIHC metric has issues as a high-level metric[30], targeting resources at households with low income and high energy consumption seems sensible.

Rather than assessing policy performance via movements in high-level metrics, tracking estimates of total expenditure reductions/welfare gains achieved seems desirable. This implies greater weight should be given to collecting and improving studies evaluating alternative interventions. This recommendation goes against a conclusion of Hills (2012) that there should be greater integration between high-level metrics and fuel poverty policies. [31]

Given the distributional choices inherent to fuel poverty, an idealised policymaking approach would be:

[30] See Heindl and Schuessler (2015).

[31] Hills (2012), Recommendation 6, page 11 states: "The Government should use the LIHC Indicator and fuel poverty gap as the basis for operational target setting".

(i) Democratically elected representatives determine the resources for fuel poverty alleviation after assessing a broad range of evidence.
(ii) Resources are allocated to interventions based on impact assessments identifying those delivering the greatest welfare improvements for a given cost.

Unfortunately, there are two issues with this neat split. First, selecting interventions by their effectiveness has implicit distributional effects by influencing which households receive support. Supporting particular interventions for distributional reasons, rather than on effectiveness grounds, could be legitimate as long as policymakers recognise the opportunity costs involved.

The second issue is whether the political process, and media debates, are sufficiently sophisticated to move away from a single headline metric to consider a range of evidence when assessing fuel poverty. Unfortunately, as Thomson et al (2016) describe under 'path dependency', classifying a metric as 'official' can lead to it receiving undue attention, and political debates' sophistication cannot be guaranteed. In such a world the choice of 'official' fuel poverty definition, by altering the reported fuel poverty rate, may alter the resources allocated to fuel poverty alleviation.

Assessing Interventions' Effectiveness

While stressing the importance of evaluating individual interventions, executing these evaluations is not necessarily straightforward. First, the value of performing affordability specific assessments must be recognised and appropriate resources provided. It is not automatic that energy efficiency interventions maximising carbon savings are most effective for reducing fuel poverty.

Furthermore, Deller and Waddams (2015c) highlight that assessments of energy efficiency investments rely heavily on assumptions. These assumptions fall into two categories: (i) those concerning incentives and market prices, and (ii) technical assumptions about the energy required to heat homes to an acceptable level. Estimates of financial savings based on engineering models should be treated with caution. For example, Fowlie et al (2015) compare the predicted and actual financial returns to households receiving funds from the US's Federal Weatherization Assistance Program. Although the realised data showed a negative internal rate of return, the scheme's engineering models projected a positive return. One reason for estimated savings not being realised is that engineering models using 'ideal' temperatures will overstate pre-intervention energy costs if a household heats their home to a lower than 'ideal' temperature. A critical issue when assessing the 'under-heating' of homes is identifying where individuals *prefer* lower temperatures.

Given these challenges, the value of the EU collating impact evaluation studies not only comes from sharing information on effective interventions, but also from sharing best practice on the methodologies used to assess interventions. While collating impact evaluation studies should accelerate the identification and adoption of effective interventions, the extent of the policy synergies across MS suggested by Thomson et al (2016) is unclear. When interpreting results from different MS, MS' differing circumstances need to be considered; it seems logical that learning will be greatest among MSs with similar circumstances.

Final Remarks

Eurostat's energy expenditure share data highlights considerable variations in energy affordability between EU MS, with a particularly large divide between the EU15 and NMS. This divide, and the inherent linkage between fuel poverty and distributional concerns, means an EU-wide fuel poverty policy is inappropriate and the value of a common fuel poverty metric is limited.

Simulating policy interventions highlights the risks of placing excessive emphasis on high-level fuel poverty metrics. Instead, greater official attention should be given to assessing, and developing the tools to assess, the welfare gains that specific interventions deliver. Identifying effective interventions and disseminating this knowledge is an appropriate role for the EU that should ensure the limited resources for fuel poverty alleviation achieve maximum impact.

5. Appendix: Simulations – Additional Detail

Data differences between the UK, France and RoI

As noted above the expenditure surveys in the UK, France and RoI were conducted in different years using different methodologies. The following comparisons between MS are provided for context and the statistical significance of differences has not been tested.

Before reporting results it is worth detailing differences between the datasets and households of the MS. First, in France and the RoI total expenditure includes all housing costs, while in the UK imputed rent for owner-occupiers is excluded. Second, the Enquête Budget de Famille includes some of France's overseas territories. Weighting ensures the dataset is representative of France and the overseas territories combined. Since the population of mainland France far exceeds that of the included overseas territories, the results should be driven by data from mainland France.

Regarding differences in household characteristics, median household expenditure in the RoI in 2009-10 was around a third higher than in the UK in 2012 and was approximately 50% higher than France in 2010-11. Second, Figure A1 shows the RoI has a far higher proportion of households utilising fuels other than gas and electricity than the UK (53.3% vs 7.4%). The higher percentage of Irish households using alternative fuels corresponds to this indicator being less effective for targeting high energy expenditure households: in the UK households using alternative fuels have the second highest ENEX10, while in the RoI these households have only the eighth highest ENEX10. Third, the RoI has a younger age profile than the UK: the percentage of households containing someone aged 65 or over is 10 percentage points lower in the RoI, while the percentage of households with children is 10 percentage points higher.

Some target groups are defined differently in the French dataset. Older households in France are identified by the head of the household being aged 65 or over rather than a household containing at least one person aged 65 or over. Furthermore, the percentage of households receiving 'housing benefit' in France is 18% compared to less than 4% in the UK suggesting the policies referred to as 'housing benefit' are rather different.

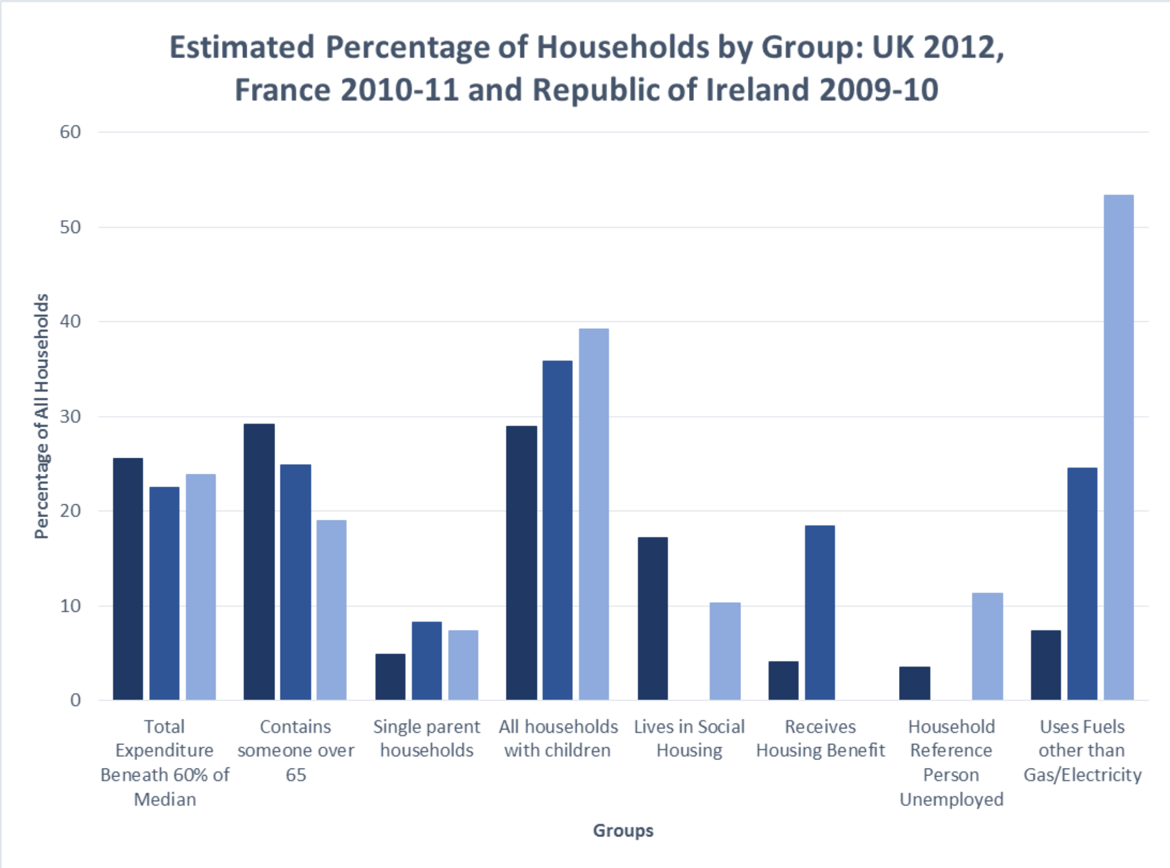

Figure A1: The percentage of households in France, the UK and RoI in particular target groups[32]

In all three MS households with total expenditure below 60% of the median have the highest rate of ENEX10 fuel poverty. However, that only a minority of low income households in each MS were in ENEX10 fuel poverty illustrates the limitations of using income alone to target fuel poverty policies.

Differences in interventions' 'effectiveness'

Considering Figures 11, A2 and A3, in all three MS the most effective interventions are expenditure reductions targeted at low income households. Similarly, in all three MS targeting older households is moderately effective, with the targeting power of these households appearing strongest in the RoI.[33] In the RoI targeting households in social housing is roughly as effective as targeting low income households and more effective than targeting the unemployed. Another feature of the RoI is that targeting a €250 expenditure reduction at households with the highest energy expenditure shares is, relative to other interventions, reasonably effective. In the UK and France this intervention has a very low effectiveness, suggesting that in the RoI households with the highest energy expenditure shares have expenditure shares closer to the ENEX10 threshold. Lastly, in France, households receiving disability benefit is the second most effective target group after those on low incomes.

[32] The definitions of groups can vary between the MSs. Where no bar is present a dataset did not contain an appropriate group identifier.

[33] Relative to applying the relevant monetary intervention to all households.

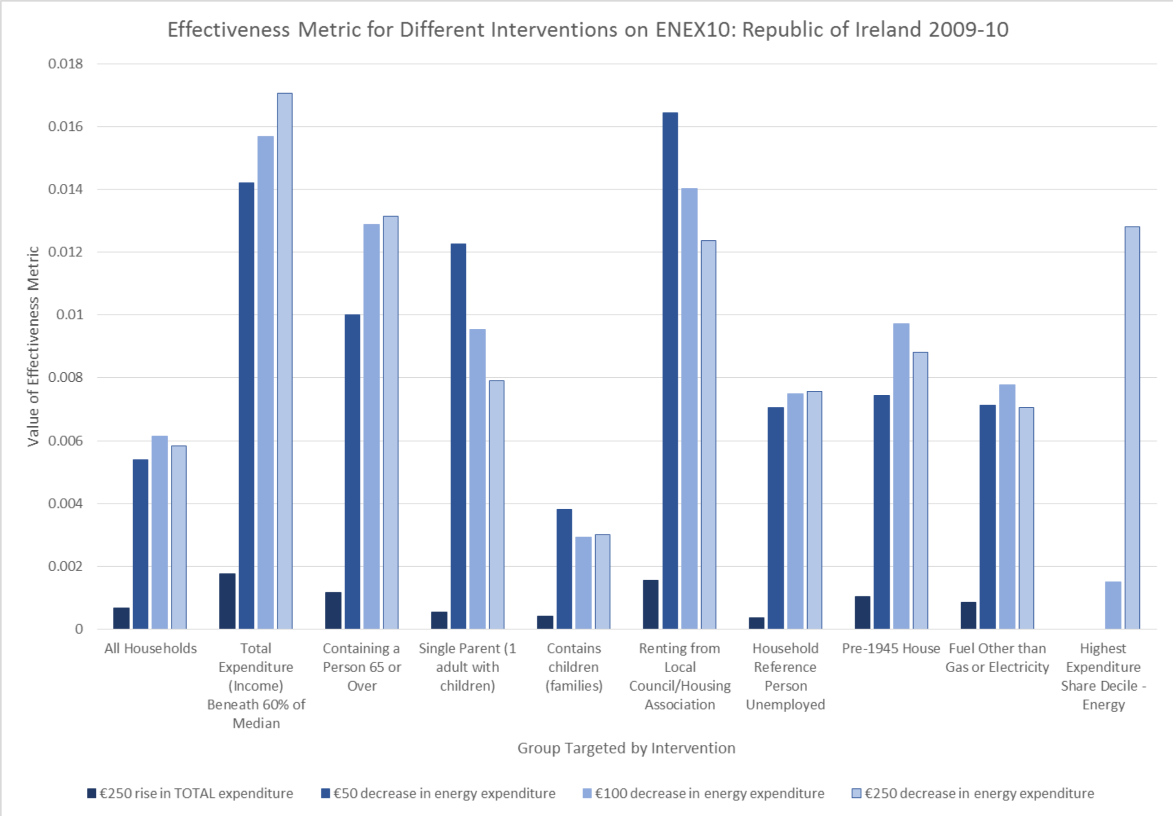

Figure A2: Effectiveness of interventions on reducing the percentage of Irish households with an energy expenditure share exceeding 10% in 2009-10

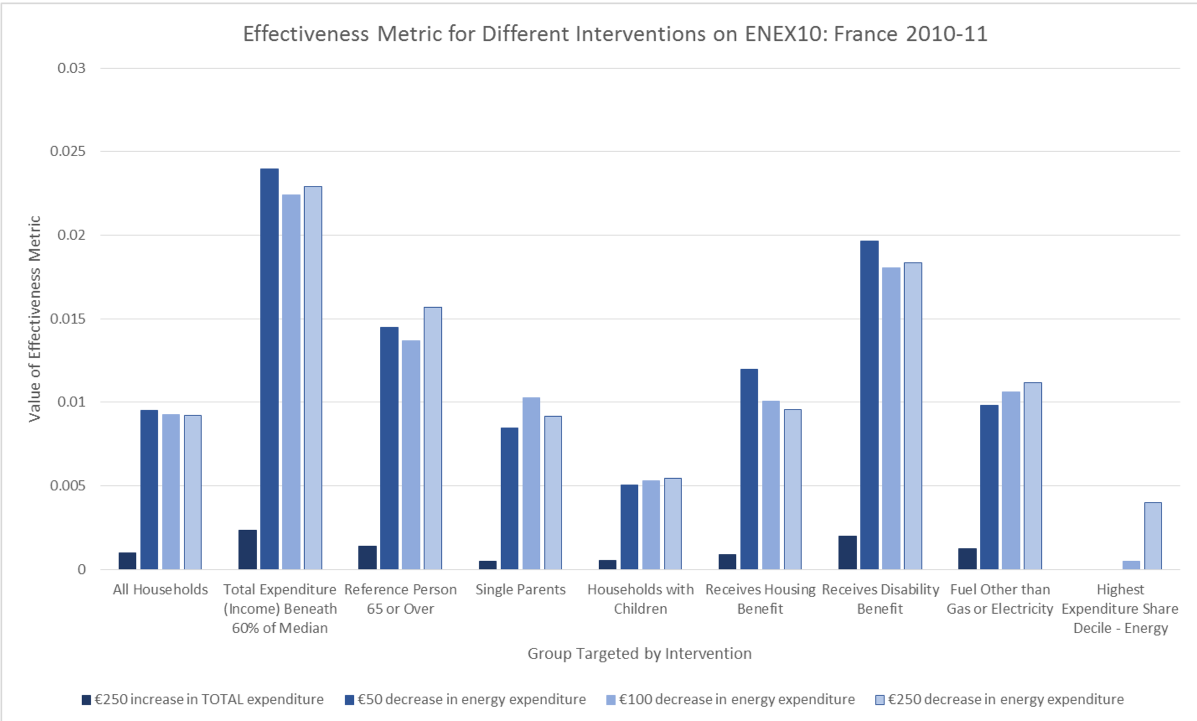

Figure A3: Effectiveness of interventions on reducing the percentage of French households with an energy expenditure share exceeding 10% in 2010-11

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